TP4 (JavaScript Version)

INF8808 : Data Visualisation

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Objectives

The goal of this lab is to create an interactive bubble chart using open data in JSON format.

Before beginning, we recommend you have completed the following readings and practice exercises :

Readings :

- Chapter 9 (p.158 - p.194) of Scott Murray's book
- Observable : 5 minute introduction

> https://observablehq.com/@observablehq/five-minute-introduction

- Observable : Observable's Not JavaScript

> https://observablehq.com/@observablehq/observables-not-javascript

Exercices :
- Chapter 7 – 1, 2, 3

Introduction

A bubble chart is a type of graphic that is used to visualize data possessing many parameters and where each point is represented by a circle. It's a combination of a scatter plot and a proportional area chart. With this type of graphic, we can encode a maximum of four dimensions: the position in x, position in y, color and area of the circles.

In this lab, you will create an interactive bubble chart using data about the CO_2 emissions per inhabitant and revenue per inhabitant, provided by the open data portal of the World Bank [1]. You will have access to data from years 2000 and 2015.

Before completing the code for the bubble chart, you will also implement a simplified version of it using an Observable notebook. The link for the notebook has been provided to you. You can fork the notebook to complete it with your own code. This notebook symbolizes an important initial step in the creation of most data visualizations, which is the exploration of the data and of design possibilities.

Description

In this lab, you will have to complete the JavaScript code using D3 in order to display a bubble chart representing the relationship between GDP and CO2 emissions. As a preliminary step, you will implement a simplified scatter plot of the data in an Observable notebook. Afterwards, you will reuse and complete your notebook's code using the code in the archive provided with this lab.

In the bubble chart, the color of each bubble represents the continent, and their size represents the population. To make the bubble chart interactive, a button toggles between views of the data from the years 2000 and 2015. When the data is updated, the circles move to their new positions gradually with an animation.

The following subsections present the different parts that you will have to complete for this lab. We recommend completing the data exploration in the Observable notebook first. Then, this code will help you to complete the implementation of the scales, followed by the animated bubble chart. The next two parts, the legend and the tooltip are independent of each other.

File Structure

To complete this work, you will need to fill the various `TODO` sections in the files from the archive provided for the lab. The comments in the code explain in more detail the steps to take.

In this lab, we provide you with an archive containing 6 JavaScript files used to accomplish the desired visualization :

- `index.js` : This file represents the entry point to the code and orchestrates the various steps needed to realise the visualization. It does not need to be modified.

- `scripts/helper.js` : This file contains some basic functions needed to display the visualization. It does not need to be modified.

- `scripts/legend.js`

- `scripts/scales.js`

- `scripts/tooltip.js`

- `scripts/viz.js`

Dataset

The dataset is located in the `src/assets/data/` directory in the archive provided for the lab. The dataset contains a table of objects for years 2000 and 2015. Each object in the tables contains the following keys :

- `Country Name` : The name of the country.

- **GDP** : The GDP per capita in current U.S. dollars.

- **CO2** : The CO2 emissions per capita in metric tonnes.

- **Population** : The population of the country.

- **Continent** : The continent of the country.

Data exploration

For this part, fork the observable notebook at the link provided to you and follow its instructions. **Make sure to keep your notebook private and not to publish it**.

In the notebook, you will implement the code to create the x and y scales, as well as scatter plots for the data 2000 and 2015. As you will see in the next parts, the implementation of a scatter plot is a simplified version of a bubble chart. Thus, we recommend you reuse the code from this part in the next parts of the lab.

Figure 1 below is included as a guideline for the expected result when this part is complete.
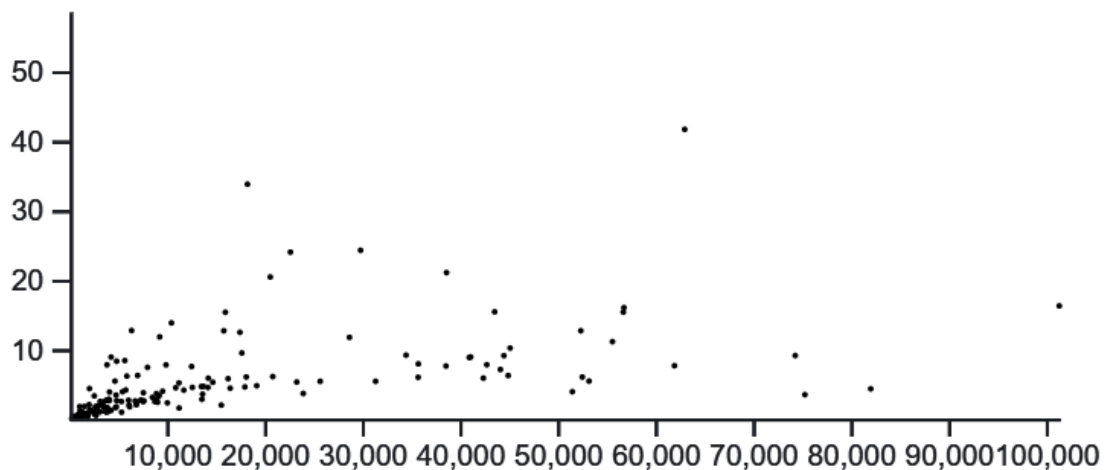

```
draw(2015, svg2015, xScale(), yScale())
```
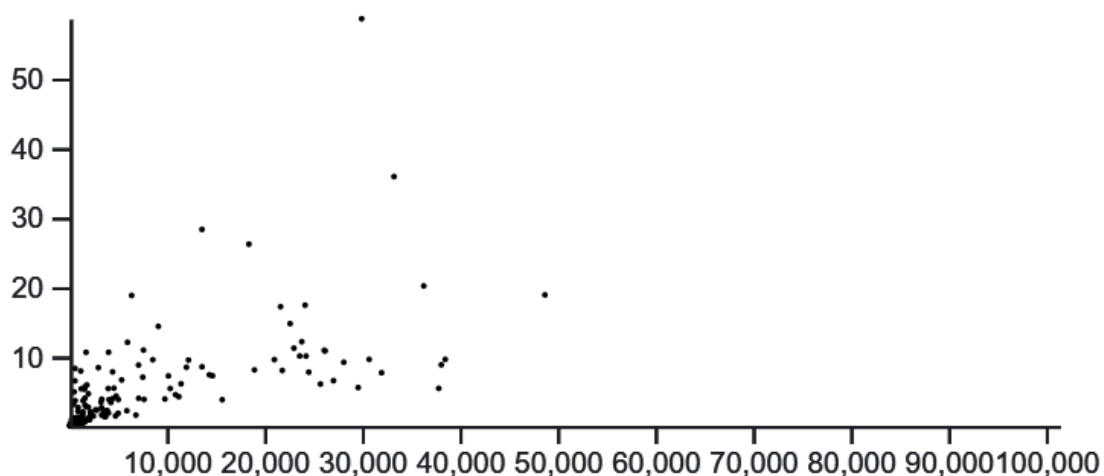

Figure 1 : The scatter plots resulting from the data exploration

Scales

For this second part, you will have to modify the code provided in the archive for the lab. The functions to complete may be found in the file `scripts/scales.js`. For this part, you will have to generate the scales used to display the bubble chart.

The radius and the color scale both will be used to determine the size and color of each bubble. The radius should depend on the size of the population of the country represented by a given marker. Similarly, the color should depend on the continent of the country represented by the given marker. The x and y scales determine the position of the center of each bubble, depending on the GDP per capita and the CO_2 emissions per capita it represents. These scales should be represented as log scales.

To sum up, the steps to complete for this part are :

1. Define the linear scale determining the radius of the circles (function `setRadiusScale`)

2. Define the color scale determining the color of the circles (function `setColorScale`)

3. Define the log scale determining the x position of the circles' centers (function `setXScale`). You can reuse part of your code from your notebook for this step.

4. Define the log scale determining the y position of the circles' centers(function `setYScale`). You can reuse part of your code from your notebook for this step.

Animated bubble chart

For this third part, the code to modify may be found in the archive for the lab. More specifically, it is in the file `scripts/viz.js`. This part consists of generating the main part of the data visualization. For this part, you will first draw the labels on the axes. Then, you will draw the circles for the visualization, including setting their interactive behavior. Normally, the circles' opacity must be 70%, and it must go up to 100% while a given circle is hovered by the cursor. The outline of the circles is white. When hovered, an informational tooltip must also be displayed, the content of which is determined in the next parts of this lab. Further, you will need to ensure that when the data is updated, the circles move gradually to their new position using a D3 transition. Finally, the title of the graphic must always reflect the current display year.

Thus, these are the steps you will need to complete for this part :

1. Position the axis labels with respect to the center of their axis (function `positionLabels`)

2. Draw the circles with the appropriate size, fill, and opacity (function `drawCircles`). You can reuse part of your code from your notebook for this step.

3. Set up the event handler on the circles to handle their behavior when they are hovered by the cursor (function `setCircleHoverHandler`)

4. Move the circles to the appropriate x and y position corresponding to the data they represent. Make sure their position changes gradually using a D3 transition (function `moveCircles`)

5. (function `setTitleText`). You can reuse part of your code from your notebook for this step.

The two charts below, Figure 2 and Figure 3, illustrate the appearance of the bubble chart for years 2000 and 2015.
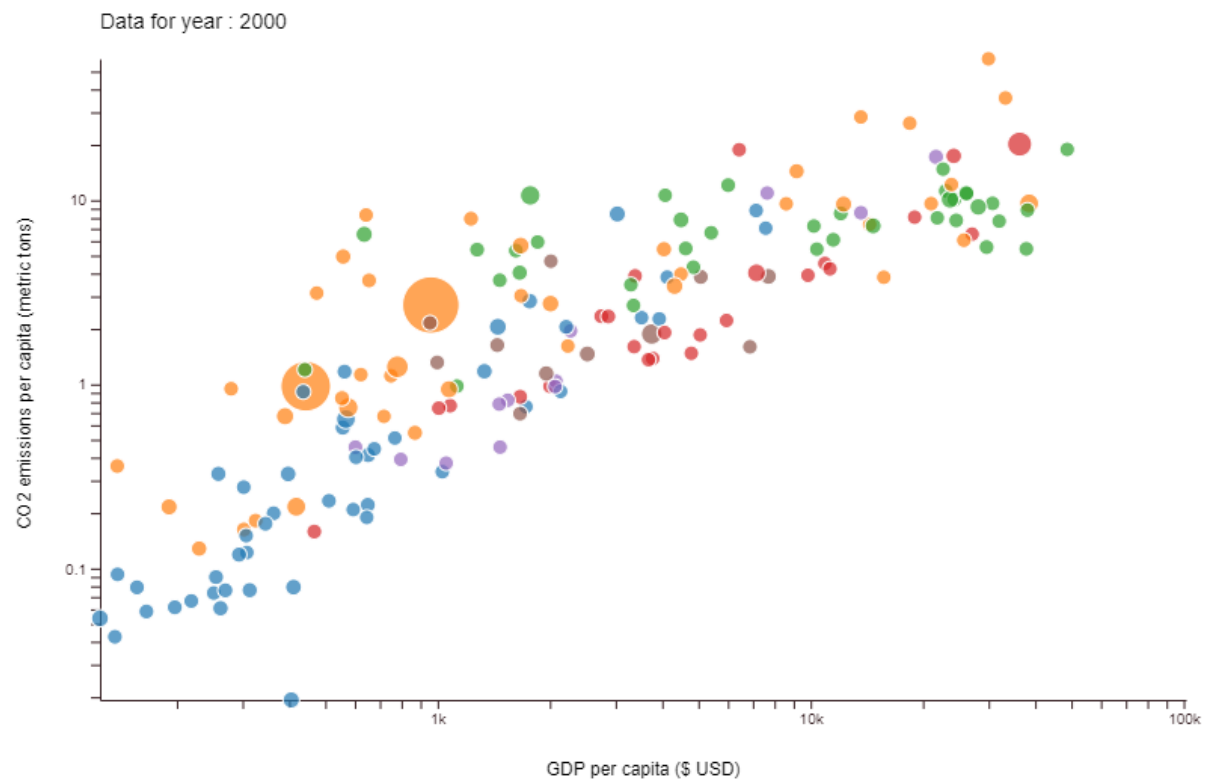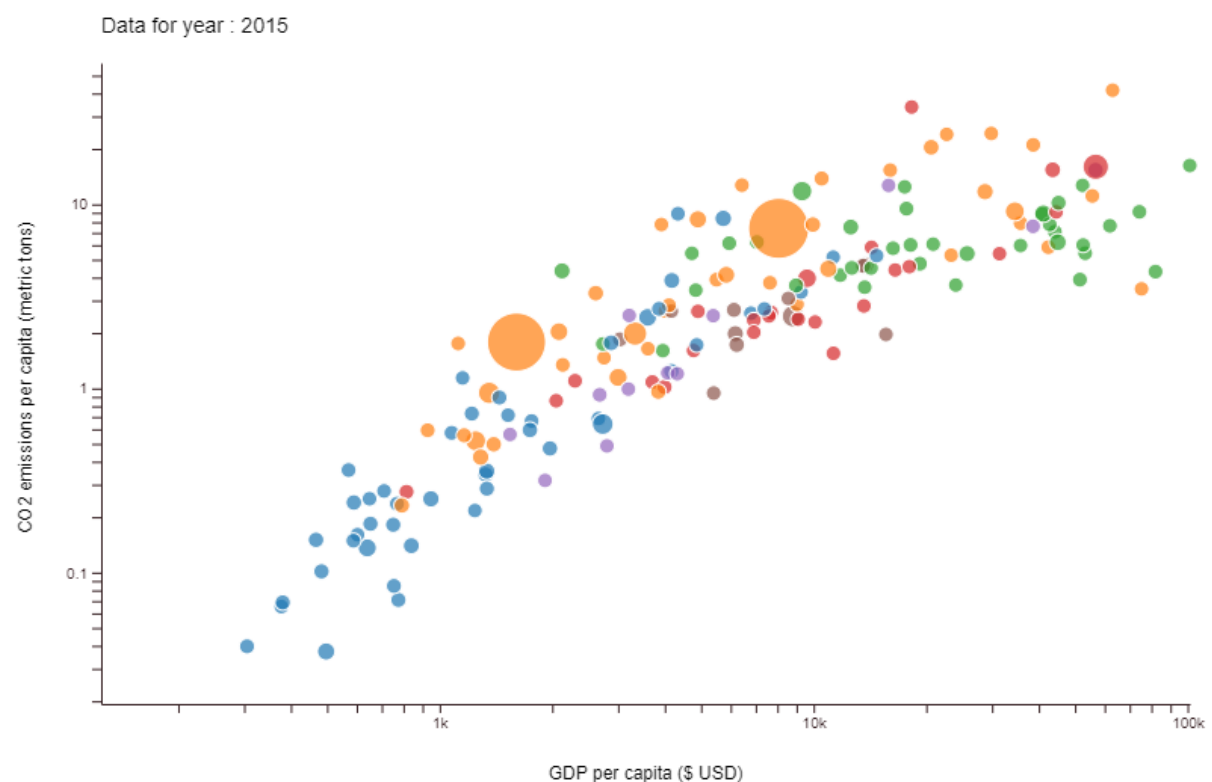
Figure 2 : The bubble chart for year 2000

Figure 3 : The bubble chart for year 2015

Legend

For this fourth part, you may continue completing the code provided in the archive for the lab. The file to complete for this part is `scripts/legend.js`.

You will generate a vertical legend at the top right of the heatmap. The legend will indicate continent each color corresponds to in color scale. Some of the code for this part may be completed using the `d3-svg-legend` library [2], which is already imported at the top of the file. Make sure the continent names appear in alphabetical order and that the markers for the legend are represented as circles.

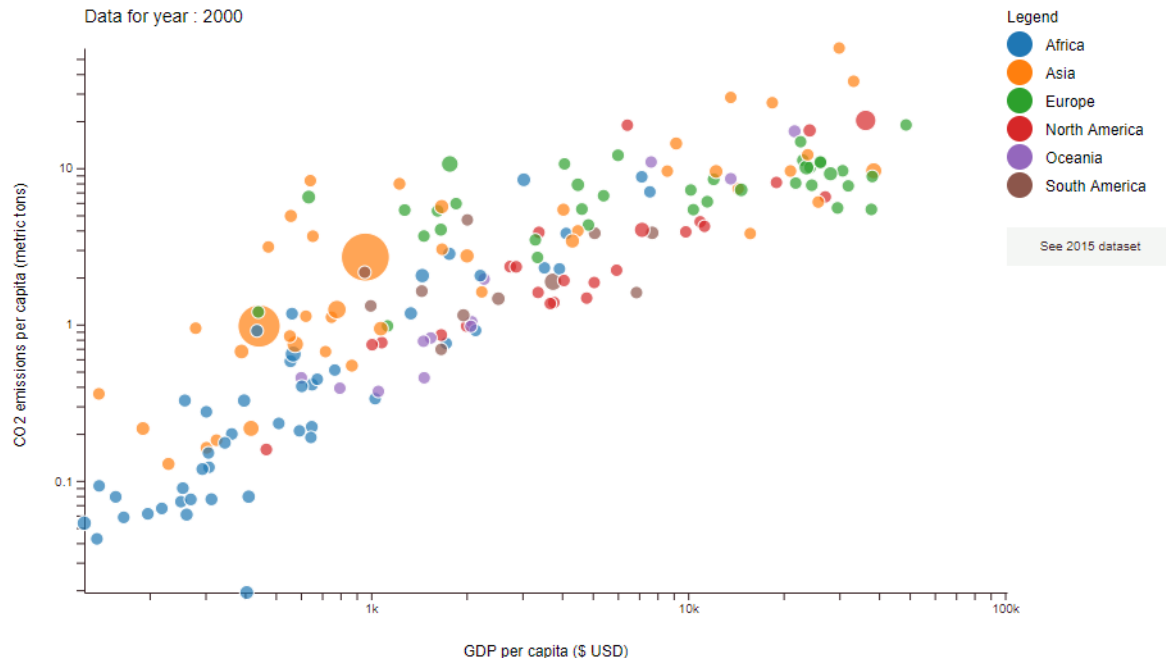In Figure 4 below, we can se what the legend for the bubble chart should look like.

Figure 4 : The bubble chart with accompanying legend

Tooltip

For this fifth part, you will need to update the code provided in the archive for the lab. The file to modify is `scripts/tooltip.js`. In this part, you will generate a tooltip which appears over each circle when it is hovered which summarizes information associated with that circle. The tooltip should contain the country's name, population, GDP per capita, and CO_2 emissions per capita, in that order. Each information should be preceded by a corresponding label and followed by the units of measurement where appropriate. The entirety of the code for this section can be written in the function `getContents`. Make sure you also handled the tooltip when you created the circles in the bubble chart.

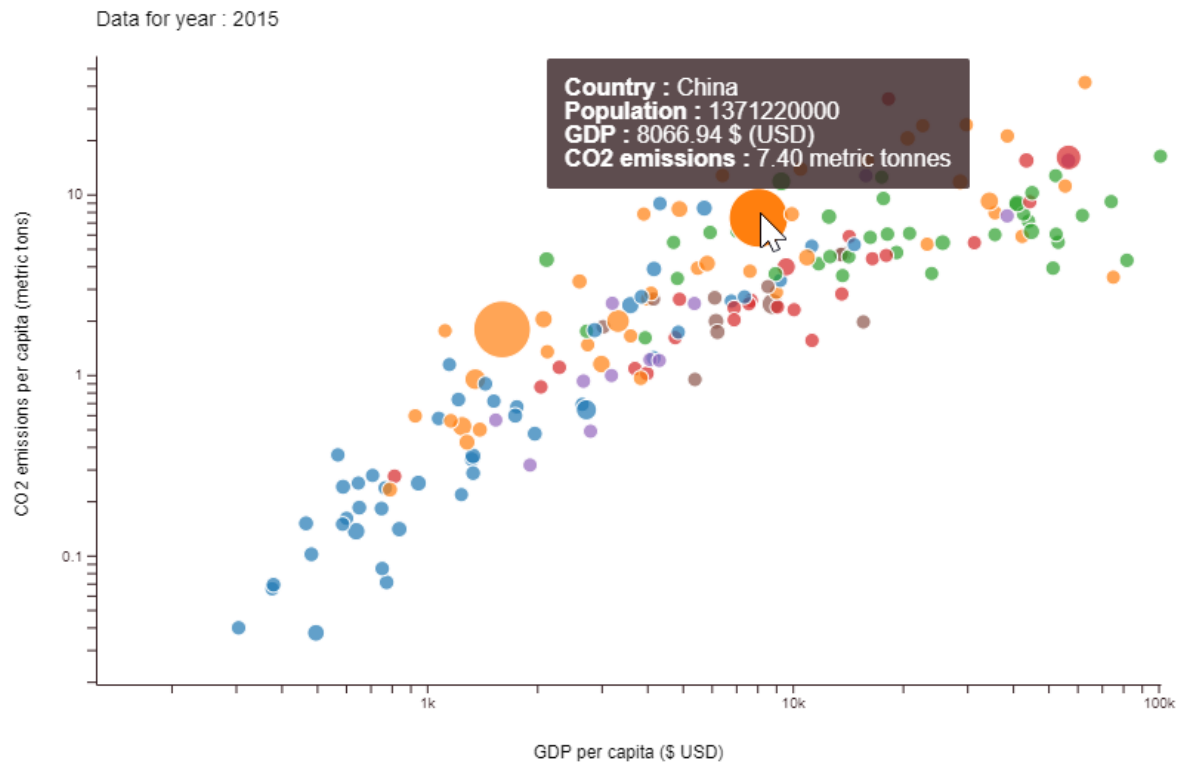The following Figure 5 is included to give a visual representation of the expected result.

Figure 5 : The bubble chart for 2015 with the bubble for China hovered

Submission

The instructions for the submission are :

1. You must place your project code in a compressed ZIP file named [matricule1_matricule2_matricule3.zip]

2. The lab must be submitted before [June 5th 23h59m]

Evaluation

Overall, your work will be evaluated according to the following grid. Each section will be evaluated on correctness and quality of the work.

Requirement	Points
Data exploration	5
Scales	3
Animated bubble chart	6
Legend	3
Tooltip	2
Overall quality and clarity of the submission	1
Total	**20**

References

[1] The World Bank, "DataBank ," The World Bank. Available: https://databank.worldbank.org/home [Accessed 01 09 2020].

[2] Susie Lu, "D3 SVG Legend ," d3-legend. Available: https://d3-legend.susielu.com/ [Accessed 01 09 2020].